

Application No. 09/880,649

Amendment and Response Under 37 CFR 1.312 dated September 14, 2004

Reply to Notice of Allowance dated July 28, 2004

Amendments to the Specification:

Please replace the three paragraphs beginning at page 10, line 25, with the following three paragraphs, the first and last paragraph being amended:

Operation of the line voltage compensation in the gun driver 10 will now be described. As shown in Fig. 2B, the electric gun driver circuit 10 is initially in a deactivated State 0 wherein the solenoid 18 has only minimal or no coil current. At State 1, the control circuit 11 receives a gun ON/OFF signal from the system control 12 in the form of a rising leading edge of a pulse. A line voltage compensator 33 includes a duty cycle control controller 35 and a fixed frequency PWM 37. The PWM 37 has an output connected to one input of an AND gate 39. The other input of the AND gate 39 is connected to the output of the hysteresis modulator 74. The duty cycle control controller 35 has inputs connected to the gun ON/OFF signal output from the system control 12 and the output voltage from the unregulated power supply 19. With the output voltage from the power supply 19 at its desired nominal value, for example, 240 VDC, the duty cycle control holds the duty cycle of the PWM 37 at 100%. Thus, all of the output from the hysteresis modulator 74 passes through the AND gate 39; and as earlier described, the initial peak current will rise to its desired value along the slope 208 of Fig. 2A.

If the power supply voltage is nonconstant and rises, for example, to 300 VDC, without any compensation, as previously described, the hysteresis modulator 74 would cause current to be supplied to the coil 14 at a rate having the slope 210 of Fig. 2A. That increased slope with no other change, increases the operational speed and decreases the actuation time of the dispensing valve 31. By opening faster, the dispensing valve 31 dispenses adhesive at a location on the substrate that is not intended to receive the adhesive.

However, with the line voltage compensator 33, that problem is eliminated. The duty cycle control controller 35 senses the increase in voltage from the unregulated power supply 19 and determines a proportionality constant

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defined by a fraction. The fraction has a numerator equal to the desired voltage, in this example, 240 VDC, and a denominator equal to the current power supply output voltage, for example, 300 VDC. Thus, in this example, the proportionality constant is 0.80, and the duty cycle ~~control controller~~ 35 sets the duty cycle of the PWM 37 to 80%. With the output from the PWM 37 reduced to 80%, only 80% of the output from the hysteresis modulator 74 passes through the AND gate 39. The switch driver 76 and power switch 48 are then modulated such that current is supplied to the coil in accordance with the slope 212 of Fig. 2B. Further, the duty cycle from the duty cycle ~~control controller~~ 35 causes the slope 212 to approximate the slope 208 of Fig. 2A. Thus, the lower 80% duty cycle reduces the effective voltage supplied to the coil 14 during the duration of the initial peak current to the desired level, and the dispensing valve 31 moves from its closed position to its open position in the desired time. In other words, the operational speed and actuation time of the dispensing valve 31 with a power supply voltage of 300 VDC is the same as when the power supply voltage is 240 VDC. Thus, the time required to open the dispensing valve is independent of changes in the line voltage at the power source 21 and resulting changes in the output voltage of the power supply 19.